We claim:

1. A microfluidic device comprising:

a substrate bearing a plurality of constrictions, each of said constrictions being separated from one another by a gap having a distance D_1;

means for passing polarizable particles in the vicinity of said constrictions; and

means for applying a dielectrophoric field to said substrate,

wherein said particles are trapped in said gap by said dielectrophoric field.

2. The device of claim 1 wherein said means for passing particles in the vicinity of said constrictions comprises:

fluid input means for inputting a fluid comprising a concentration of said polarizable particles.

3. The device of claim 2 wherein said fluid input means is a syringe pump.

4. The device of claim 1 wherein said means for applying a dielectrophoric field comprises:

an electrical signal applied to a pair of electrodes positioned on opposite edges of to said substrate.

5. The device of claim 1 wherein said electrical signal is an AC voltage at a predetermined frequency.

6. The device of claim 5 wherein the applied frequency is between about 1 Hz and about 1 Ghz.

7. The device of claim 1 wherein said electrical signal is a DC voltage at a predetermined frequency.

8. The device of claim 1 wherein said constrictions are formed on said substrate using a photolithography etch.

9. The device of claim 1 wherein said polarizable particles are selected from the group consisting of single-stranded DNA, double-stranded DNA, RNA, biological cells and polymer particles.

10. The device of claim 1 wherein said distance D_1 is in the range of about 0.1 mm to about 300 μm.

11. The device of claim 1 wherein each of said constrictions have a height in the range of about 0.5 μm to about 5.0 μm.

12. The device of claim 1 wherein said distance D_1 is about 1 μm, a height of said constrictions is about 1.25 μm and said particles are polyonucleotides of DNA or RNA.

13. The device of claim 1 wherein said constrictions are formed in a plurality of rows being separated from one another by a distance D_2 wherein said distance D_2 is selected to vary an electric field gradient of said electric field.

14. The device of claim 1 wherein said constrictions have a trapezoidal shape with side edges angled from a bottom edge.

15. The device of claim 1 wherein said constrictions are formed of a material selected from quartz and silicon.

16. The device of claim 1 further comprising a cover, said cover being coupled to said substrate with a sealing layer.

17. The device of claim 1 wherein said plurality of constrictions are arranged in regions wherein in a first said region at a first end of said device in a second region said

constrictions are arranged in tightly grouped bands and at a second end of said device said constrictions are arranged with fewer widely spaced constrictions.

18. The device of claim 17, further comprising a third region intermediate of said first regions and said second region said third region having intermediate spacing of said constrictions.

19. The device of claim 17, further comprising one or more channels coupled to end of said regions for extracting said polarizable particles from each of said regions

20. The device of claim 1, further comprising a matrix in a channel downstream from the plurality of constrictions capable of fractioning and/or analyzing the polarizable particles released from the plurality and constrictions.

21. The device of claim 1, further comprising imaging equipment to visualize the polarizable particles.

22. The device of claim 1, wherein the substrate comprises a material selected from the group consisting of SiO2, polymide, p-xylylene, PDMS or PMMA.

23. The device of claim 1, further comprising heating means adjacent said constrictions.

24. A method of concentrating a polarizable particle or molecule using the microfluidic device of claim 1 comprising the steps of:

a) providing the microfluidic device;

b) introducing a fluidic sample comprising polarizable particles or molecules; and

c) applying an electric current to the device and fluid of step b.

25. The method of claim 24 wherein the fluidic sample is introduced using a DC current.

26. The method of claim 24 wherein the electric current of step c is an alternating current (AC).

27. The method of claim 24 wherein the electric current of step c is a direct current (DC).

28. A method of concentrating particles or molecules on a silicon or glass chip using the device of claim 1 comprising the steps of:

a) providing the microfluidic device of claim 1 comprising channels;

b) dispersing a fluidic sample comprising particles or molecules through the channels;

c) applying an electric current;

d) concentrating said particles or molecules; and

e) applying said particles or molecules to the silicon or glass chip.

29. A method of improving the hybridization rate of polynucleotide molecules using the microfluidic device of claim 1 comprising the steps of:

a) providing the microfluidic device of claim 1 comprising constrictions having a concentrated polynucleotide sample;

b) introducing a probe to said microfluidic device;

c) applying an electric current;

d) concentrating said probe to the constrictions of the microfluidic device; and

e) hybridizing said probe with the polynucleotide sample.

30. A method of improving the rate of a polymerase chain reaction (PCR) using the device of claim 1 comprising the steps of:

a) providing the device of claim 1;

b) introducing PCR reaction components comprising primers, template polynucleotide and nucleotides to the device; and

c) concentrating the PCR reaction components by applying an electric current to the device.

31. A method of fractioning particles or molecules using the device of claim 13 comprising the steps of:

a) providing the device of claim 13 comprising a plurality of constrictions of varying concentration;

b) introducing a fluidic sample;

c) applying an electric current to said device; and

d) fractioning the particles or molecules by size.

32. The method of claim31 wherein the molecules are polynucleotides.